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NASA TECH BRIEF

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Double-Discharge Copper-Vapor Laser

The problem:

Recently, copper-vapor lasers have been shown to have potentially high power and efficiency in the visible spectrum. However, their typical operating temperatures are around 1,500° C, which makes them difficult to use.

The solution:

Two consecutive timed discharges have been used to produce lasing in copper chloride at 400° C.

How it's done:

A version of the copper chloride laser is shown in Figure 1. The power supply for the discharge pulses consists of two capacitors that are made to discharge synchronously with adjustable time intervals. The first pulse is switched with a hydrogen thyratron, and the second by a spark gap.

Studies on the effects of discharge time delay and the effects of temperature in copper-vapor lasers have shown that lasing action peaks for the appropriate

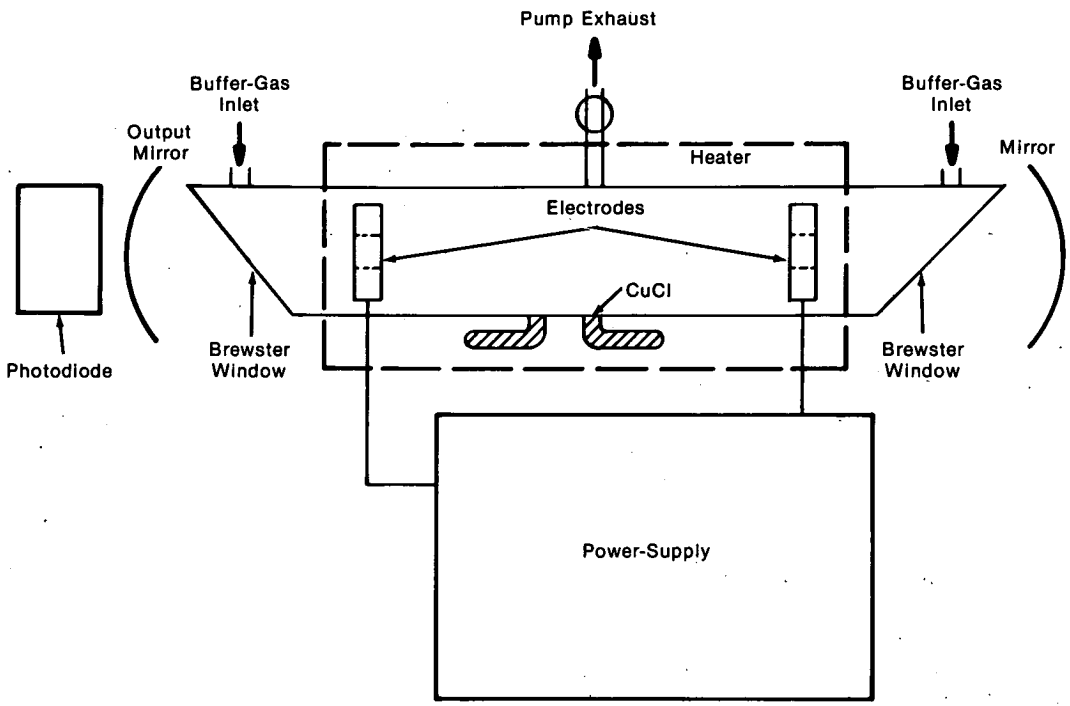

Figure 1. Schematic Diagram of a Copper-Chloride Laser

(continued overleaf)

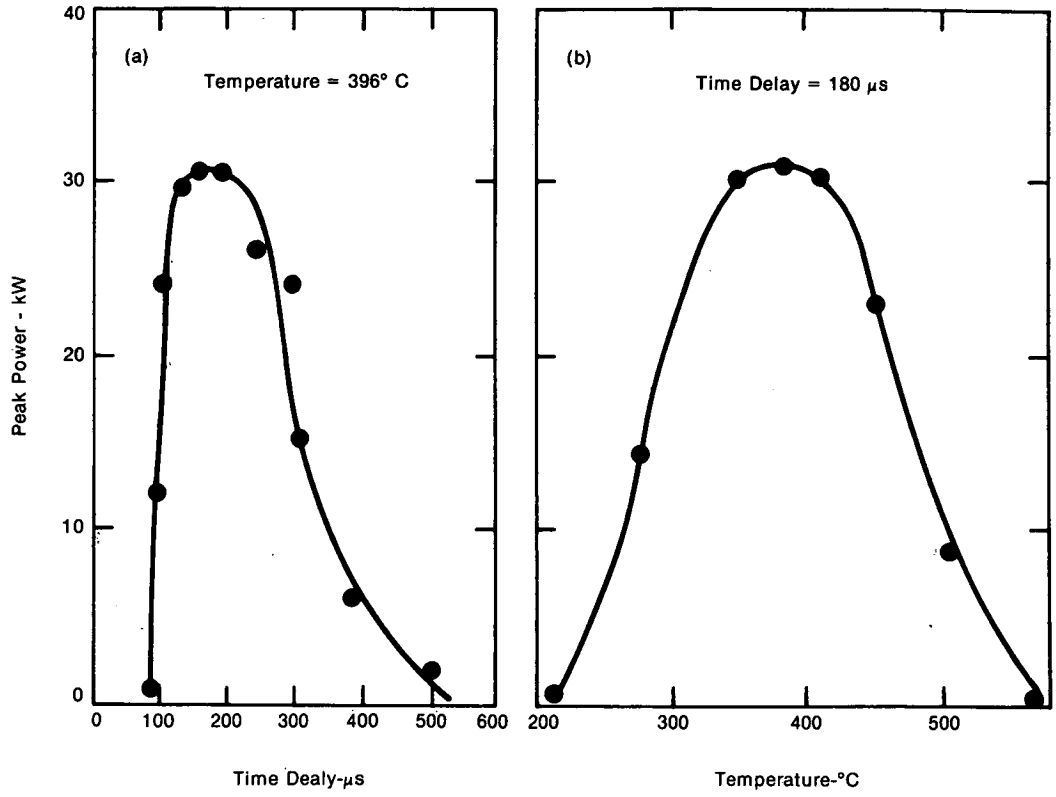

Figure 2. Dependence of Laser Peak Power on (a) Time Delay Between Pulses and (b) Temperature

combination of these two parameters. The results of one experimental measurement of these parameters are shown in Figure 2. At low temperatures, the vapor pressure is too low to provide enough copper atoms for lasing. The reason for the high-temperature limit is not clear, but the higher number density of the copper chloride vapor may lower the electron temperature and thus decrease the rate of excitation. The lower limit of time delay may represent the time required for the copper to relax to the point where it is possible to produce a population inversion with a second discharge. The upper time-delay limit is thought to be due to chemical recombination of the copper chloride.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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